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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/668,604	09/22/2000	Jiamin Qiao	CY-0005	2296

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EXAMINER	
TRAN, BINH X	

ART UNIT	PAPER NUMBER
1765	

DATE MAILED: 09/21/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/668,604	QIAO ET AL.	
	Examiner	Art Unit	
	Binh X Tran	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *22 September 2000*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-20* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 112

1. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

2. Claims 1-8, 11 are rejected under 35 U.S.C. 112, first paragraph, because the specification, while being enabling for "forming a stop layer", does not reasonably provide enablement for "[a stop layer] that is a conductive removal stop in a contact formation step". The specification does not enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make the invention commensurate in scope with these claims.

In the specification, the applicant discloses the step of depositing the conductive layer over the stop layer and the step of removing the conductive layer to form an interconnection using the stop layer as removal stop. However, applicants do not disclose how to form the conductive layer in claim 1. Applicants also do not disclose either the location of the conductive layer and the conductive layer removal step. It is impossible to form a stop layer "that is a conductive layer removal stop" without knowing how to form and how to etch the conductive layer. Thus, the scope of the claim is not commensurate with the scope of the disclosure.

In claim 11, the limitation "forming a conducting interconnect structure after removing a first conductive layer" is not commensurate with the scope of the disclosure.

It is impossible to remove a "first conductive layer" without knowing the location of the first conductive layer.

Claims 2-8 and 11 are rejected under 35 U.S.C. 112, first paragraph, because they directly or indirectly depend on claim 1.

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 3-5, 13-14, 17-18 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 3 is indefinite because it depend on itself (i.e. "The method of claim 3...")

Claims 4-5 are indefinite because they depend on indefinite claim 3.

In claim 13 applicants disclose the stop layer includes a layer of "SixNyOz, where X and Y are integers and Z is an integer that can include zero". It is possible that X, Y, and Z equal to zero since the applicants do not indicate that X and Y must be greater than zero. When X, Y and Z all equal to zero, the material for the stop layer is indefinite because it comprise "nothing" (i.e. $Si_0N_0Z_0$).

In claim 17 applicants disclose the stop layer includes a layer of "SixNyOz, where X and Z are integers and Y is an integer that can include zero". As discussed above, it is possible that X, Y, and Z equal to zero. When X, Y and Z all equal to zero, the material for the stop layer is indefinite because it comprises "nothing" (i.e. $Si_0N_0Z_0$). Since the material for the stop layer comprise "nothing", the examiner reserves the right to interpret that any composition will read on this limitation.

Claims 14 and 18 are indefinite because they depend on claim 13 or claim 17.

Claim Rejections - 35 USC § 102

5. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

6. Claims 1, 8-9, 11-13, 15, 17-18 are rejected under 35 U.S.C. 102(e) as being anticipated by Jang et al. (US 5,840,624).

Respect to claims 1 and 9, Jang discloses a method comprising the steps of:

removing the first conducting layer (22) over a stop layer (20) having a contact hole (i.e. via hole 21) formed therein, with the stop layer as a removal stop (Fig 6);

etching a borderless contact pattern into an insulating layer (23) formed over the stop layer (20), with the stop layer as an etch stop (Fig 7, col. 5 lines 35-52).

Respect to claim 8, Jang discloses the borderless contact etch includes a reactive ion etch (RIE, col. 5 lines 35-45). Respect to claim 11, Jang discloses forming a conducting interconnection structure (22) after removing the conductive layer (Fig 6) and forming the borderless contact pattern exposes at least a portion of the of the conducting interconnect structure (Fig 7).

Respect to claim 12, Jang discloses that the interconnection structures contacts with the contact structure (Fig 8).Respect to claim 13, Jang discloses the insulating

layer (23) includes silicon oxide (col. 5 lines 24-25) and the etch stop layer (20) includes silicon nitride (SiN, col. 5 lines 54-55). It is known in the art that silicon oxide have the formula SiO_2 (SiO_2 aka silicon dioxide, See prior art Huang (US 6,406,987) made of record). Therefore, the examiner interprets that Jang discloses the insulating layer is silicon dioxide.

Respect to claim 15, Jang discloses a method comprising:

forming a stop layer (20) between the first insulating layer (19) and the second insulating layer (23) having a substantially slower removal rate than a conductive material (22) in a step that removal the conductive material;

forming a contact (structure position in via hole 21) in the first insulating layer, the etch stop layer (20) having a substantially slower removal rate than the second insulating layer (23) in the etch step that form borderless contact pattern (via 25) in the second insulating layer (23) (See Fig 6-7, col. 4-5). Respect to claim 17, Jang discloses the conducting material (22) includes a metal (col. 5 lines 30-32) and the stop layer comprises silicon nitride (SiN, col. 5 lines 54-55). The limitation of claim 18 has been discussed above.

Claim Rejections - 35 USC § 103

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 2-3, 6, 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang in view of Inou et al. (US 5,604,374).

Respect to claim 2, Jang fail to disclose the stop layer is a composite layer that includes at least two different materials. In a semiconductor process, Inou teaches the stop layer is a composite layer of two materials (col. 6 lines 60-65). It would have been obvious to one having ordinary skill in the art, at the time of invention, to use the composite layer having at least two different materials because it enhance selectivity of the etching process.

Respect to claims 3 and 14, Inou discloses the stop layer comprises silicon dioxide and silicon nitride. Respect to claim 6, Inou teaches the stop layer includes the first layer having a thickness of 30 nm and a second layer having a thickness of 70 nm (col. 7 lines 1-5, read on "less than 1500 angstrom thick").

10. Claims 4-5 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang and Inou as applied to claim 3 above, and further in view of Hedge et al. (US 6,136,682).

Respect to claim 4-5, Jang and Inou fails to disclose the stop layer includes silicon oxynitride layer. However, Inou clearly discloses the stop layer is a composite layer having silicon nitride as one of the component. Hedge discloses a composite etch stop layer comprises silicon nitride and silicon oxynitride (col. 6 lines 10-12). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Jang and Inou in view of Hedge by using silicon oxynitride as one of the component for the composite etch stop layer because equivalent and substitution of one for the other would produce an expected result.

11. Claims 7, 10 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Jang in view of Liaw (US 6,448,140).

Respect to claims 7, 10 and 16, Jang fails to disclose the contact formation step includes chemical mechanical polishing. However, Jang clearly disclose using RIE to create the contact. In a semiconductor, Liaw discloses using either chemical mechanical polishing (CMP) or RIE to create the contact structure (col. 6 lines 16-30). It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Jang in view of Liaw by using CMP to create a contact because equivalent and substitution of one for the other would produce an expected result.

12. Claim 19 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jang in view of Yoshida (US 6,255,700).

Respect to claim 19, Jang fails to disclose the insulting film includes silicon dioxide having a concentration of phosphorous dopant greater than 5% by weight. However, Jang clearly discloses the insulating layer is silicon dioxide. In a semiconductor process, Yoshida discloses a PSG (silicon dioxide doped with phosphorous) having a concentration from 8-12 wt%. It would have been obvious to one having ordinary skill in the art, at the time of invention, to use PSG having a concentration greater than 5-wt% because this would enhance the etching of the insulating layer.

13. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Jang and Yoshida as applied to claim 19 above, and further in view of Inou et al. (US 5,604,374).

Respect to claim 20, Jang fail to disclose the stop layer comprises undoped silicon dioxide. In a semiconductor process, Inou teaches the stop layer comprises undoped silicon dioxide. It would have been obvious to one having ordinary skill in the art, at the time of invention, to modify Jang and Yoshida in view of Inou by using doped silicon dioxide because it enhance selectivity of the etching process.

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Huang (US 6,406,987) discloses that silicon oxide comprise SiO2 (col. 3 lines 25-30).

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Binh X Tran whose telephone number is (571) 272-

1469. The examiner can normally be reached on Monday-Thursday and every other Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine G. Norton can be reached on (571) 272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Binh X. Tran

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER